Chagres River, and the flora of the rocky islands of Panama Bay, A report covering some of these features of the lecture was published in the *Journal of the New York Botanical Garden* for February, 1910.

The speaker justified a somewhat extended discussion of the Panama Canal and its history by the general interest in the subject both here and on the Isthmus. Among the photographs shown were several of the Atlantic and Pacific entrances to the Canal, the Gatun locks, a flood on the Chagres River, the Culebra Cut, the Ancon Hospital, and the Taboga Sanitarium. The success of modern sanitary methods in combatting yellow fever and malaria was especially dwelt upon. The speaker alluded also to incidents of interest in the romantic early history of the Isthmus and in the building of the Panama Railroad. Photographs of the ruins of Old Panama, located about five miles east of the present city, were also shown.

Adjournment followed.

SERENO STETSON,
Secretary pro tem.

OF INTEREST TO TEACHERS*

COLLEGE BOTANY NOTES

An interesting set of sheets giving some of the directions for freshman and sophomore botany has been provided us by Professor Clements of the University of Minnesota. Drawings form quite a prominent part of the work as might be expected. It is directed that the drawings be drawn to scale—a thing which is more important than most of us realize. The following recommendation is also made: "As a rule, write the answers to the questions first, and make the drawings afterward." The procedure is often exactly the opposite, with the result that the drawing shows but indifferently the characteristics of the plant parts under consideration. Structure and function are too often too widely separated—in time at least—even in general courses in botany. In the work on plant cells and tissues given below

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one can see clearly that very different drawings would be made before and after answering the questions.

1. Cell and protoplasm (Lat., cella, room: Gr., protos, first plasma form).

(*a*) Mount a leaf of the water weed, *Philotria*. Note the structure of the cell, the position of the green bodies, chloroplasts, and especially the movement of the protoplasm. Compare various cells.

(*b*) Mount a stamen of the spiderwort, *Tradescantia*, taking care not to crush it. Note the structure of the stamen-hair, and especially the streams of protoplasm and the nucleus.

Answer the following questions definitely but briefly: (1) Explain the different shapes of the cells. (2) What indicates that the wall is elastic? (3) Do the streams of protoplasm change their shape, position, or direction? (4) What forms the "banks" of the streams? (5) Find the rate of flow. (6) Does the protoplasm pass from one cell to the next? (7) How and why does it line the cell wall? (8) Explain the position and shape of the nucleus. (9) Does the nucleus move? If it does, explain how. (10) Do the streams center at it? Do they flow into it or over it? (11) What fills the bulk of the cell? Draw to scale a cell of *Philotria*, showing the wall and chloroplasts; draw a cell of the stamen-hair, showing wall, streams of protoplasm, nucleus, etc.

Almost all of the work is carried on in the field and greenhouse. Lectures and books are replaced by independent laboratory (in the widest sense) work by the students. It means time, patience, and real teaching power on the part of the instructors if the students are to solve for themselves the problems of physiology and work out the structural adaptation to function. It is also felt at the University of Minnesota that the students are more interested by and in work of this type than by the usual method of lectures, and text and reference books.

The beneficial effects of soil bacteria have lately received much emphasis. The *Outlook* notes popularly the recent investigation of injurious soil bacteria—(October 29, 1910) at the experiment station at Rothamsted, England. "It occurred to the experimenters at Rothamsted that perhaps there exist similarly in the soil, not only the "good" microbes that can be reinforced at will, but "bad" organisms that, as in the human system, are at warfare with the benefactors. And this was demonstrated to be a fact. Perhaps, then, they thought, we can not only reinforce the helpful organisms by addition from without, but treat the soil with something that will kill or minimize the effect of those undesirable. Isolating the organisms and experimenting with them, it was soon found that various antiseptics, in liquid and in vapor form, will kill or paralyze the undesirable organisms, and hence, if applied to soils, materially increase their yield, even without a reinforcement of the army of their natural enemies, the ammonia-forming bacteria; and at length it was discovered that heat alone will answer every purpose. Partial sterilization of the soil by heat, while destroying some of the desirable bacteria, totally destroys those that prey upon them. Cans of earth from the same field heated to about the temperature of boiling water yield enormous growths of leaf and seed compared with identical samples unheated. Here is the sign-post that points to a most fascinating path of research. Perhaps some way will be found to apply this discovery practically. Experiment will not rest here, although it seems at first thought impossible to *heat* the soil over any large area; yet in greenhouses it might pay, where the area under cultivation is relatively small and the crop relatively very valuable. A lady of our acquaintance found it impossible to grow certain flowers in a pot; the seeds germinated, but the plants failed to mature. Thinking that there might be some worm or grub in the soil that attacked the seeds or the roots, and that heat might kill it, and as fresh soil was not easy to secure in the city, she put the pot in the oven and baked the contents. Afterwards there was no trouble when the seeds were again planted. She had unconsciously confirmed the Rothamsted experiment, destroying the harmful bacteria. Professor

Hall, the writer of the article which is the subject of this review, concludes as follows, after admitting the difficulty of applying this remedy on a large scale: "Sooner or later, our trials will reach a cheap and practical issue. But if we do succeed, we shall have added one more to the number of new discoveries which are as old as time: Virgil in his Georgies describes the advantages to be obtained by mixing the surface soil with weeds and rubbish and burning it gently, and the practice is still followed among the native cultivators in India." This, Mr. Hall concludes means a warfare "against an invisible population, of which the very existence was unsuspected a generation ago." And the results are due to the killing of "unsuspected groups of large organisms of the protozoan class, which feed upon living bacteria," and heating or treatment by antiseptics relieves the bacteria which partially escape the treatment from their attack, allowing them to increase to an enormous degree, with a corresponding rise in ammonia production—and therefore of fertility. —*Science*, September 16, 1909.

The October *Journal of the New York Botanical Garden* contains an article by George V. Nash on "Winter Decorative Shrubs." Over thirty such shrubs are listed with brief descriptions. School grounds are usually planted with summer decorative shrubs, and are consequently not at their best during the greater part of the school year. It is possible to use winter shrubs in such a way as to add to the summer display, and yet leave a well-balanced and pleasing scheme during the winter.

A recent paper by Alma G. Stokey on *Lycopodium pithyoides* notes the fact that in this species the sporangia are cauline rather than folia, through continued inequality in the rate of growth which causes it eventually to take a "position on the stem entirely distinct from the leaf."

The Japanese are going to replace the cherry trees presented to Mrs. Taft by Japan to adorn the Potomac Drive at Washington, and which had to be destroyed on arrival because they were infected by insects.